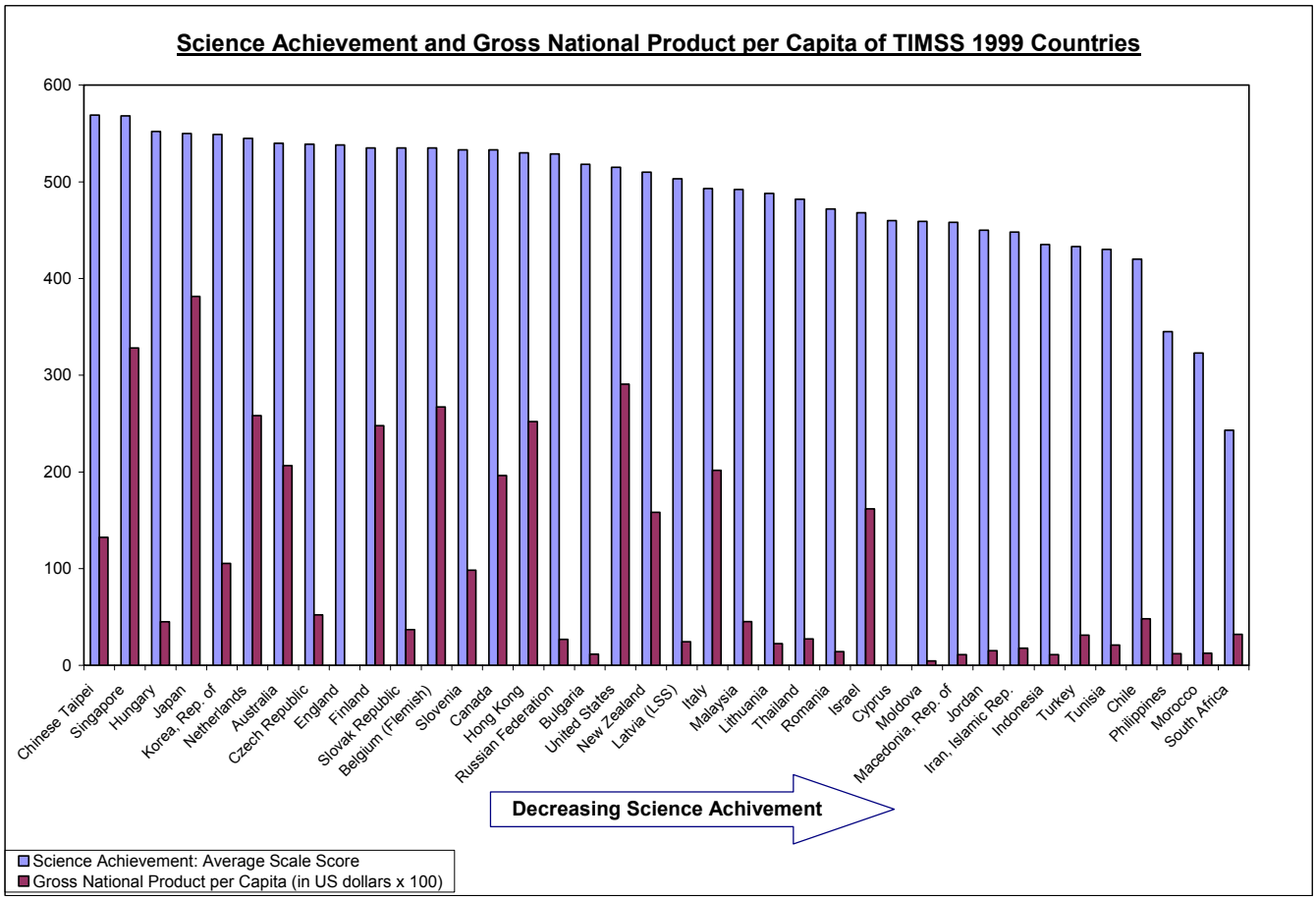
CHEMISTRY EDUCATION FOR DEVELOPMENT

John D Bradley, RADMASTE Centre, University of the Witwatersrand, Johannesburg, South Africa

A Key Role

We live in an age of globalisation and technological progress. Opinions differ as to whether this is entirely good or bad, but whatever the opinion we are all caught up in it. We know too that in the recent decades, the gap between richer countries and poorer countries has widened. These trends are of concern with regard to social stability and social justice both within countries and between them. And they have a special relevance to chemistry educators, because in every country governments recognise the importance of science and technology for national development. There are few, if any, exceptions: rich or poor, conservative or liberal, democratic or otherwise, they all agree. And they all acknowledge that the need is not just for professional scientists and engineers, but also for a broad scientific literacy. So as chemistry educators we have a key role: if we deliver successfully our country prospers; if we do not our country falls behind!

How Are We Doing?



One of the indicators of the level of success in science education in a country is the results of the Third International Mathematics and Science Study (TIMMS) in 1995, and its sequel TIMMS-Repeat, in 1998.

Thirty eight countries participated in the sequel, of which Turkey was one and my own country, South Africa, was another. South Africa, with a population of 40.6 million and a GDP of $ 3 210 per capita, was bottom (38^{th}) in both maths and science. Turkey, with a population of 62.5 million and a GDP of $ 3 130 per capita, did somewhat better (31^{st} in maths, 33^{rd} in science)(all data for grade 8 (Howie (2001)). Looking at the listed countries you notice that richer countries (as measured by the GDP) did better than poorer countries, and that there are no countries of the least-developed category on the list. The absence of these least-developed countries reflects their lack of capacity rather than unwillingness to participate. It is nevertheless reasonable to presume that they would show a lesser achievement than Turkey and South Africa.

Closing The Gap

How can Turkey and South Africa, and the much larger number of less-fortunate countries, get ahead? How can they ever catch up? How can chemistry educators in these countries be reached and helped to play their key roles? I am not suggesting that chemistry educators in richer countries lack for nothing, and are all wonderful. We all know that is far from the truth. But they have internal mechanisms and resources that can in principle do what is necessary. They can help themselves if they have the will.

I would like to review some partial answers to these questions, emphasising the actions undertaken by IUPAC. The mission of the International Union of Pure and Applied Chemistry (IUPAC) is captured in the declaration "Advancing Worldwide Chemistry". It pursues this in a number of different ways, two of which have relevance to the present theme:

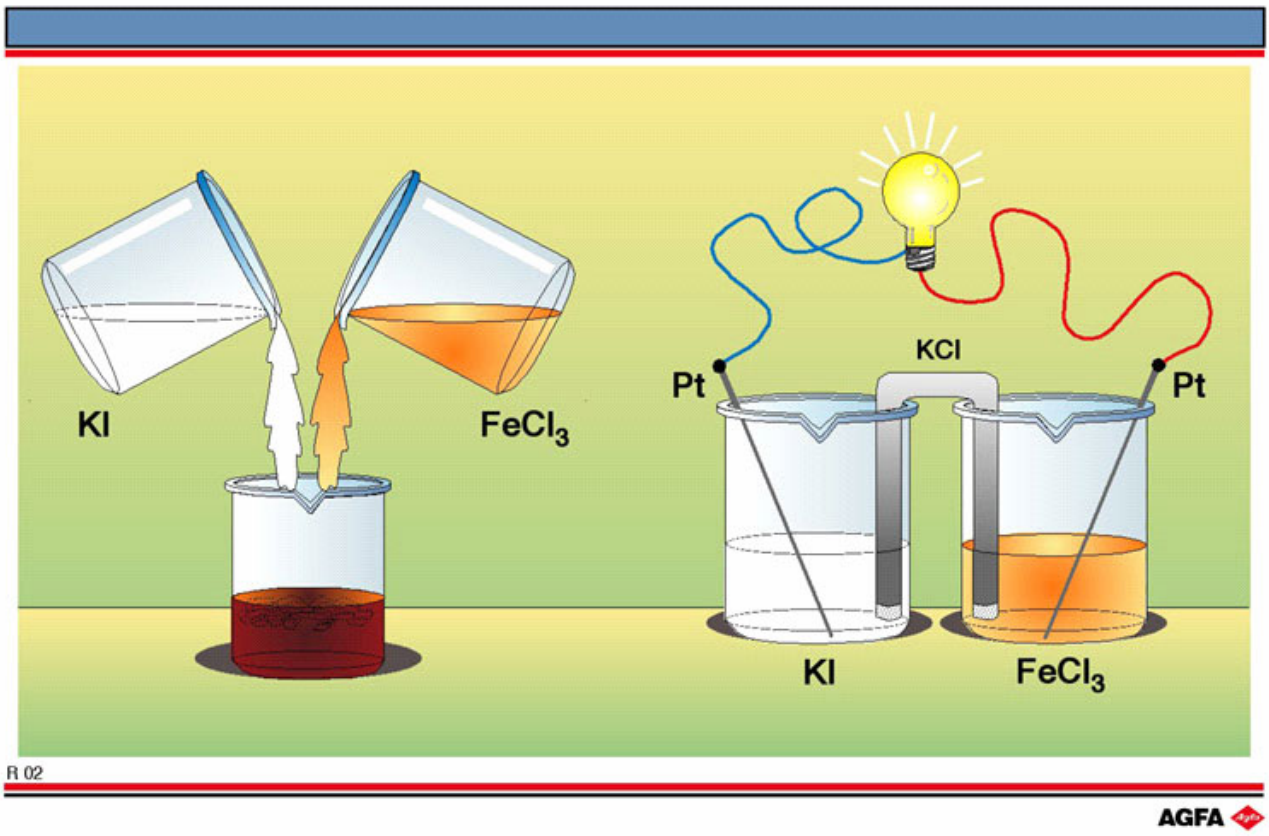
"IUPAC's mission is to advance the worldwide aspects of the chemical sciences and to contribute to the application of chemistry in the service of mankind."
"IUPAC will utilize its global perspective to contribute toward the enhancement of education in chemistry and to advance the public understanding of chemistry and the scientific method."

It is within this policy framework that a number of initiatives have been undertaken.

Basic Needs

Chemistry educators however inventive need resources. In some countries a textbook is all they can expect. But teachers need more than that. They need reliable sources of chemistry information; they need pictorial matter (posters, transparencies, videos); they need resources for practical activities. All of these have been receiving attention in joint programmes of IUPAC and UNESCO during the past few years:

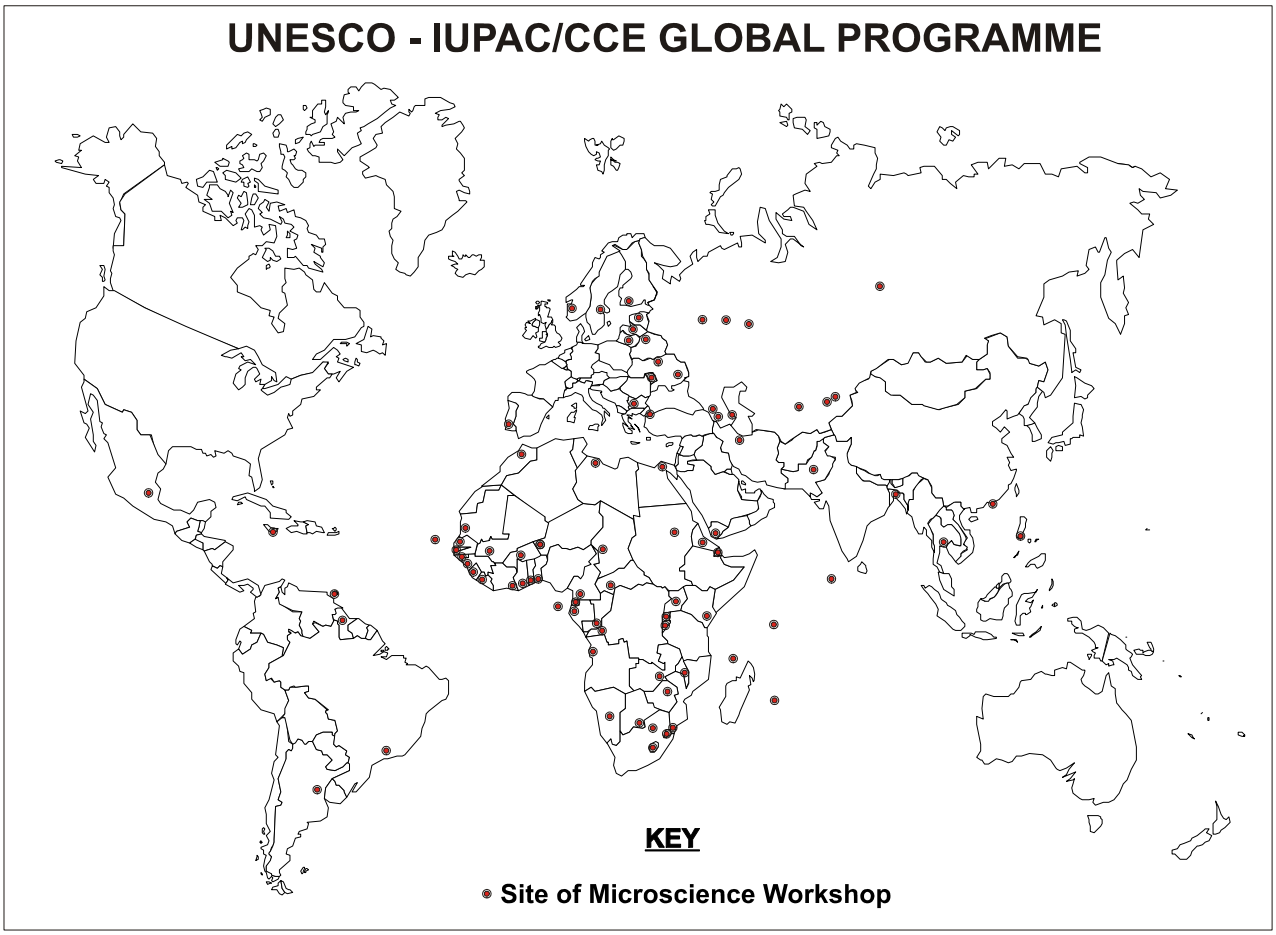
(1) The DIDAC teaching resources were originally created in Belgium (Brandt and Michiels, 2003), and were quite expensive to acquire in their original form. They comprise a series of nearly 300 colourful transparencies (language-free), supported by text for the chemistry teacher (IUPAC, 2004). Following endorsement of the material by IUPAC's Committees on Chemical Industry and on Teaching of Chemistry attempts were made to achieve wider dissemination in cooperation with UNESCO. Books and CDs have been prepared and posters have been printed from some of the transparencies. These different formats now cater for both well-equipped and poorly-equipped classrooms. The teacher text is now available in six languages. These resources have been distributed free with UNESCO extra-budgetary funds.



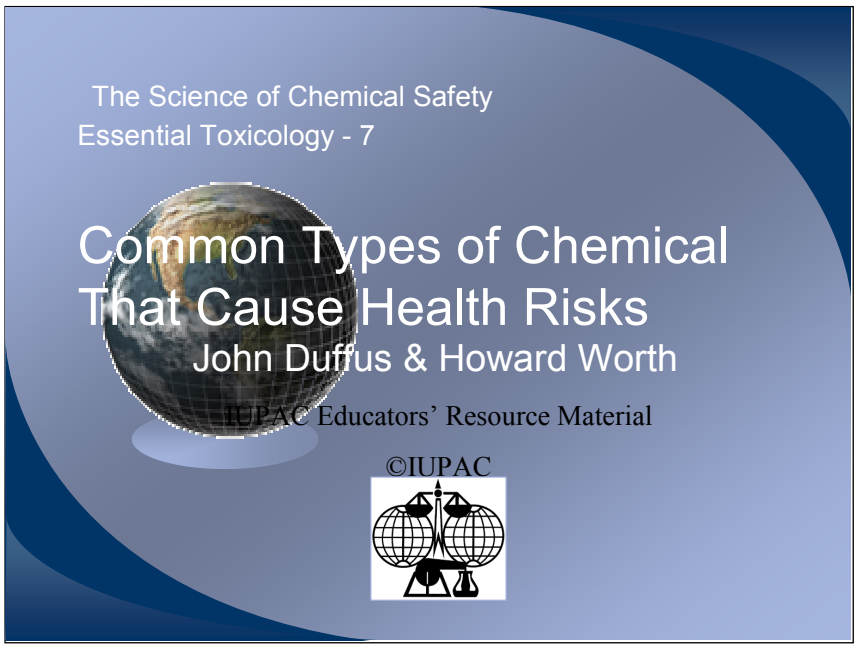
Transparency RO2: Redox Reactions

DIDAC Chapter 3: Electrochemistry *Copyright: 2003 Agfa-Gevaert N.V.*

(2) The microchemistry concept has been promoted by IUPAC and UNESCO through workshops in more than 70 countries as a possible solution to the lack of resources for practical work in chemistry (Bradley, 2001). Pilot projects have been completed in more than half of these, and workbooks are now available in several languages. Worksheets in some major languages are already installed on the UNESCO website (UNESCO, 2005). Several UNESCO-Associated Centres have been established to provide continuing support in different regions. Some 15 countries have adopted the system as national policy and have acquired microchemistry kits and chemicals using their own national budget and donor funds. As Beasley and Chant observed in Australia nearly 10 years ago (Beasley and Chant, 1996) "the trend from macro is now established", and this program has contributed significantly to realising this vision globally.



(3) Essential Toxicology is the title of a resource that originates from a joint project of IUPAC's Commission on Toxicology and Committee on Teaching of Chemistry. A CD has been prepared from the original text which provides for a Powerpoint presentation on the subject for secondary school and tertiary-level teachers (Duffus and Worth). The aim is to sensitise and inform chemistry teachers who have usually not received any initial or subsequent training thereon. Preparation and dissemination of the CD has been facilitated by UNESCO.



Essential Toxicology – Unit 7: Slide 1 – Common Types of Chemicals That Cause Health Risks
Copyright: Duffus & Worth, IUPAC

Moving Up

If basic needs have been satisfied there is much more that chemistry educators should have in order to achieve more. They need to be able to improve themselves continuously. But this too cannot go far without inputs and resources. A number of initiatives have been taken also to address this problem, of which two will be mentioned here.

(1) The Chemistry Clearing House idea has been initiated in Russia with the support of IUPAC. This has been established in Moscow to adapt and disseminate recommended materials and methodologies that have originated in IUPAC and other reputable sources to the Russian-speaking community of chemistry educators. This achieves an enrichment and professional development objective with respect to educators who may not have access to the original English-language materials. Clearly, language is an important controlling factor in exchange of information and ideas, and other major language groups might wish to study and follow this example. An encouraging report on initial progress has been made (Gryzlova and Kozyreva, 2004) but it will be important to achieve local sustainability. IUPAC is not in a position to extend permanent funding, however desirable the project.

(2) Chemical terminology concerns all who teach chemistry. Unfortunately textbooks around the world are not necessarily reliable sources on correct usage. There is an IUPAC publication (the "Gold Book") that deals with this. There are also other coloured books covering nomenclature and units and symbols. All of these represent the authoritative, internationally-accepted guidance we need. However, they need to be greatly reduced in scope, and then interpreted for educators with additional pedagogic commentary. An earlier attempt to achieve this was published in the Newsletter of the Committee on Teaching of Chemistry (Bradley, Brand and Gerrans, 1993), and it attracted warm support from many quarters. A new project to begin this task (A Glossary of Chemical Concepts) will be proposed to IUPAC in the near future.

The Role of ICCEs in Development

Those who attend an International Conference on Chemical Education (ICCE) are fortunate. They have an opportunity to engage in professional intercourse, to learn a lot and to teach others in this very diverse, stimulating international meeting. This good fortune brings responsibility. An ICCE is a unique biennial event in the international calendar which we should learn to exploit to help chemistry educators around the world fulfill their role. Most of us go home stimulated and energised, and a few of us successfully transfer these feelings and the new knowledge to one or two of our close colleagues. I think we could do more. There are two areas to explore: in the host country and back home.

Firstly I think the presence of so much knowledge and experience in the country should be more formally exploited by the organising of courses and workshops, specifically for teachers and education officials in that country or in that geographical region. This is not meant to imply that foreigners always have better ideas: but they usually will have insights and experiences which are different if not better. Of course there are difficulties, for example of language, but they have to be overcome.

Secondly "back home" we should make greater efforts to avoid the loss of all the stimulus and energy that often occurs. One idea to consider is for IUPAC (or other body) to award Fellowships (or some such conception) to individuals, which will enable them to attend the ICCE at no cost, on submission of an approved programme of follow-up and dissemination. Wherever possible there should be financial support in the country of origin for the implementation of the programme, making it a true cooperative action.

Such actions in the host country and back home, could make a new, meaningful contribution to chemistry education for development.

References

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